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ABSTRACT

This study investigated developmental differences in the use of the common features abstraction strategy and the exemplar learning strategy for concept acquisition. Subjects were 30 second graders and 30 fifth graders. The concepts to be learned were two categories of artificial animals which differed on five dimensions. Each dimension had three possible values. Attention to more than one dimension was necessary for categorization. One half of the second and fifth grade subjects learned the two categories in the concept reception condition, which encouraged abstraction of common features from concept exemplars. The remaining subjects at each age level learned the animals in a paired associate learning condition, which encouraged subjects to memorize individual exemplars. Training trials were followed by a categorization test. Subjects in both conditions were shown 18 animal pictures and were asked to categorize each animal into one of two categories. Among the results, fifth graders were more successful at categorization than second graders. Second graders in the paired associate condition categorized more items correctly than second graders in the concept reception condition. It was concluded that the concept acquisition strategies of young children appear to be based on extensional information, i.e., concept exemplars, rather than on intensional criteria such as defining features. (Author/PH)

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Developmental Differences in Concept Acquisition Strategies

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Numerous investigators have characterized children's classifications as unsystematic and deficient with respect to the use of defining or common features as organizational principles (Bruner, Olver, & Greenfield, 1966; Inhelder & Piaget, 1964; Vygotsky, 1962). However, children organize and acquire complex natural concepts. If indeed children have difficulty in abstracting defining features for concepts, than a strategy other than the abstraction of common features might underlie children's concept learning. Developmental differences in the use of two concept acquisition strategies, common feature abstraction and exemplar learning were investigated in this study.

First, it is important to have a clear idea of the nature of the two concept acquisition strategies to be considered. For the common feature abstraction strategy to be optimally used, members of a concept must share some features, and categorization of an item as a member of the concept would occur if and only if that item possessed these common features. From a processing viewpoint, subjects take an active part in concept learning. They formulate hypotheses as to which features are shared by concept exemplars, and test these hypotheses against subsequent exemplars until a feature or combination of features is consistently confirmed as the correct basis for the categorization of an item. The concept can then be represented by its defining features, common to all or most exemplars of the concept, or what is called the intension of the concept.

Exemplar learning as a concept acquisition strategy assumes that a concept consists of a set of exemplars of the concept, and that a new item is categorized on the basis of its similarity to one or more of the concept exemplars. Stated

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in processing terms, an exemplar learning model assumes that subjects memorize individual exemplars of a concept and identify new instances of a concept by drawing analogies to the most similar stored exemplars. Unlike the common feature abstraction strategy, the exemplar learning strategy does not entail a summary representation of concepts, such as defining features. Categorization is based on comparisons made with the concept exemplars or the extension of the concept.

This study investigated developmental differences in the use of the common features abstraction strategy and the exemplar learning strategy for concept acquisition. Many natural concepts exist for which it is difficult to specify defining features (Rosch & Mervis, 1975). Since natural concepts appear to have a complex structure, it may be difficult for young children to use the common feature strategy for concept acquisition, since any single feature will only provide probabilistic support as a categorization cue. However, young children might very well be able to remember one or two examples of a particular concept. It is predicted that the second-graders in this study will be more successful at concept acquisition using an exemplar strategy. Older children, depending on the complexity of the conceptual structure, may be able to abstract common or correlated features as the basis for conceptual organization. The fifth-graders in this study should be successful categorizers if they employ either common features abstraction strategy or an exemplar strategy.

The subjects were 30 second-graders (mean age 7 years, 10 months) and 30 fifth-graders (mean age, 10 years, 9 months). The concepts to be learned were two categories of novel animals. The animals differed on five dimensions: body design, number of legs, length of legs, length of neck, and type of tail, each of which had three possible values or features. The features of the animals are presented in Table 1. Each animal exemplar possessed 3 or 4 of the sufficient features

for its category. For example, an animal from category A might have dots and six legs, which were long. The remaining dimensions were filled by features shared by exemplars from both categories, in this case, a medium length neck, and no tail. The two categories of animals were constructed such that no single feature was both necessary and sufficient for membership in either category. If the subject chose to categorize the animals on the basis of presence or absence of one particular feature, e.g., two legs, the subject would categorize 66.7% of the animals correctly. The artificial animal categories were constructed so as to model the correlated feature structure of some natural categories, as well as to control for feature variation and subjects' previous experience with the concepts.

One-half of the second-and fifth-grade subjects learned the two categories in the concept reception condition. The concept reception condition encouraged abstraction of common features from concept exemplars. The subjects were told that there were two kinds of animals, each category being labeled by a nonsense word. The subjects were shown an animal picture, guessed the category to which it belonged, and were given corrective feedback on their categorizations. Each of 6 animal pictures (3 from each category) was presented individually over 10 trials.

The remaining subjects at each age level learned the animals in a paired associate learning condition. The subjects' task was to associate each of the individual animals with a common masculine first name, such as Tom, during the 10 training trials. The paired associate condition was designed to encourage subjects to memorize individual exemplars. No category information was given to the subjects in the paired associate condition during the 10 training trials.

Prior to a categorization test, subjects in both conditions were given one trial in which they were told the category membership of each of the 6 training items. This trial was identical to the previous ten trials for subjects in the concept reception condition. This was the only trial on which paired associate subjects received category information about the individual items.

For the categorization test, subjects in both conditions were shown 18 animal pictures (6 old items and 12 new items) individually, and were asked to categorize each animal into one of the two categories. At the conclusion of the categorization test, the subjects were asked to explain how they made their categorization decisions.

The prediction for categorization performance was an age by condition interaction. The second-graders were predicted to be more successful at categorizing the animals using an exemplar strategy following training in the paired associate condition. The fifth-graders were predicted to be more successful than the second-graders at abstracting the sufficient feature structure of the stimuli, and were predicted to be successful categorizers following concept reception training.

The mean percentages of items correctly categorized are presented in Table 2. There was a significant effect of age with fifth graders more successful at categorization than second-graders (F (1, 56)=13.22, $p < .001$). There was an age by condition interaction as predicted (F (1, 56)=24.75, $p < .001$). Second graders in the paired associate condition categorized more items correctly than second graders in the concept reception condition (Means= 80.4%, 70.4%, F (1, 56)=4.69, $p < .05$). Fifth graders in the concept reception condition categorized more successfully than second-graders in the concept reception condition (Means= 92.9%, 70.4%, F (1, 56)=37.00, $p < .001$). The fact that there was no difference in categoriza-

tion performance between second and fifth grade subjects in the paired associate condition (Means=80.4%, 76.3%, F (1, 56)=1.00) suggested that an exemplar strategy could be used successfully by subjects at both ages as a categorization strategy.

An implicit assumption of this study has been that subjects in the paired associate condition used an exemplar learning strategy, i.e., they stored individual concept exemplars and categorized new items by drawing analogies between the new items and the old items.

An alternative possibility was that subjects in the paired associate condition implicitly abstracted the underlying two category structures of the stimuli during training. It is difficult to understand how subjects could have simultaneously abstracted two different category structures when they did not know there were different types of exemplars during training. One empirical test of this explanation was to consider the percentage of within-category name confusions during the paired associate training trials. By chance, forty percent of the naming errors would be within-category errors. The actual percentages of within-category errors were 47% and 36% for second graders and fifth graders, respectively. These proportions were not significantly different from what would be expected by chance (z=.33, z=.39). It does not appear that subjects in the paired associate condition abstracted category information during training.

Support for the original assumption that subjects in the paired associate condition drew analogies between the new items and the individual, previously memorized old items was provided by the subjects' explanations for their categorization decisions. One-half of the subjects in the paired associate condition made explicit mention of the old items as the basis of their categorization decisions. For example, one second-grade subject said, "I thought about the old ones, you know, that looked

like Tom." One fifth of the concept reception subjects mentioned the old items. There was a significant difference between the proportions of subjects in each condition who mentioned the old items as the basis for their categorizations ($z=2.47$, $p < .05$).

One obvious implication of the results was that the common feature abstraction strategy used by subjects in the concept reception condition was in no sense an optimal approach to concept learning for the youngest subjects. The exemplar learning strategy, or categorizing on the basis of stored exemplars was used successfully for categorization by both second- and fifth-graders.

The use of an exemplar strategy may provide an alternative interpretation of children's unsystematic classification behavior. Rather than assuming that young children's groupings are nonstrategic, it is possible to consider the organization of these groups as exemplar to exemplar comparisons. While no single criterial feature or set of features may be used consistently to include every item in a group, similarity between successive items may be the organizational basis of the groupings. The child compares one object to the next, then that object to the next. Another possibility is that the child might focus on one exemplar as the basis for the set and include other objects which are similar in a variety of ways to the central instance. Reliance on extensional information, i.e., concept exemplars, rather than intensional criteria such as defining features characterizes young children's concept acquisition strategies.

References

Bruner, J. S., Olver, R. R., & Greenfield, P. M. Studies in cognitive growth. New York: Wiley, 1966.

Inhelder, B., & Piaget, J. The early growth of logic in the child. London: Routledge and Kegan Paul, 1964.

Rosch, E. & Mervis, C. B. Family resemblances: Studies in the internal structure of categories. Cognitive Psychology, 1975, 7, 573-605.

Vygotsky, L. S. Thought and language. New York: Wiley, 1962.

Table 1

Feature Structure of Categories

	Sufficient Features		Shared Features
	Category A	Category B	Categories A and B
Dimensions			
Body Design	dots	stripes	plain
Number of Legs	six legs	two legs	three legs
Length of Legs	long legs	short legs	medium legs
Length of Neck	short neck	long neck	medium neck
Type of Tail	straight tail	curly tail	no tail

Note: Each exemplar possessed 3 or 4 of the sufficient features for its own category and 1 or 2 of the shared features.

Table 2

Mean percent of correctly categorized items
by grade, condition, and item type

	Concept Reception Condition			Paired Associate Condition		
Grade	Old	New	Total	Old	New	Total
2nd Grade	76.7	67.2	70.4	82.2	79.4	80.4
5th Grade	94.4	92.2	92.9	71.1	78.9	76.3